

10/009018 ✓

JC18 Rec'd PCT/PTO 06 DEC 2001 ✓

Practitioner's Docket No. AP9650

CHAPTER II

**TRANSMITTAL LETTER  
TO THE UNITED STATES ELECTED OFFICE (EO/US)**

**(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)**

PCT/EP00/05295 ✓	8/June/2000 ✓	8/June/1999 ✓
INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED

Electromagnetic Valve  
TITLE OF INVENTION

Peter Volz  
APPLICANT(S)

**Box PCT**  
**Commissioner for Patents**  
**Washington D.C. 20231**  
**ATTENTION: EO/US**

*NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495.*


**WARNING:** *Where the items are those which can be submitted to complete the entry of the international application into the*

**CERTIFICATION UNDER 37 C.F.R. 1.10\***

*(Express Mail label number is mandatory.)  
(Express Mail certification is optional.)*

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 12/06/01, in an envelope as "Express Mail Post Office to Addressee," Mailing Label Number EV 051 007 728 US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Joyce Krumpe  
*(type or print name of person mailing paper)*

  
Signature of person mailing paper

**WARNING:** *Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.*

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"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,439, at 56,442.*

T. 0009018 120601

*national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. §1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C.F.R. §1.8*

*NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 USC 371 otherwise the submission will be considered as being made under 35 USC 111. 37 C.F.R. § 1.494(f).*

1. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:
  - a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).
  - b. ☒ The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

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## 2.Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
[ ]*	TOTAL CLAIMS	6 - 20 =		x \$ 18.00 =	\$
	INDEPENDENT CLAIMS	1 - 3 =		x \$ 84.00 =	
	MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$280.00				
BASIC FEE**	<p>[ ] U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO:</p> <p>[ ] and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(2) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) ..... \$100.00</p> <p>[ ] and the above requirements are not met (37 CFR 1.492(a)(1)) ..... \$710.00</p> <p>[X] U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO:</p> <p>[ ] has been paid (37 CFR 1.492(a)(2)) ..... \$740.00</p> <p>[ ] has not been paid (37 CFR 1.492(a)(3)) ..... \$1040.00</p> <p>[X] where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) ..... \$890.00</p>				
	Total of above Calculations				= 890.00
SMALL ENTITY	Reduction by ½ for filing by small entity, if applicable. Affidavit must be filed. (note 37 CFR 1.9, 1.27, 1.28)				-
	Subtotal				890.00
	Total National Fee				\$ 890.00
	Fee for recording the enclosed assignment document \$40.00 (37 CFR 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				\$ 890.00

\*See attached Preliminary Amendment Reducing the Number of Claims.

- i. ☐ A check in the amount of \_\_\_\_\_ to cover the above fees is enclosed.  
ii. ☒ Please charge Account No. 18-0013 in the amount of \$ 890.00.  
A duplicate copy of this sheet is enclosed.

**\*\*WARNING:** "To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: \* \* \* (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).

**WARNING:** If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.

3. ☒ A copy of the International application as filed (35 U.S.C. 371(c)(2)):

**NOTE:** Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36 See item 14c below.

- a. ☒ is transmitted herewith.  
b. ☐ is not required, as the application was filed with the United States Receiving Office.  
c. ☐ has been transmitted  
i. ☐ by the International Bureau.  
Date of mailing of the application (from form PCT/IB/308): \_\_\_\_\_.  
ii. ☐ by applicant on \_\_\_\_\_.  
Date

4. ☒ A translation of the International application into the English language (35 U.S.C. 371(c)(2)):

- a. ☒ is transmitted herewith.  
b. ☐ is not required as the application was filed in English.  
c. ☐ was previously transmitted by applicant on \_\_\_\_\_.  
Date  
d. ☐ will follow.

5. ☐ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

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[illegible]

- (Transmittal Letter to the United States Elected Office (EO/US)—page 5 of 8)

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iii. ☐ will follow.

Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

- a. ☒ is transmitted herewith.  
 b. ☐ has been transmitted by the International Bureau.  
 Date of mailing (from form PCT/IB/308): \_\_\_\_\_.  
 c. ☐ is not required, as the application was searched by the United States International Searching Authority.  
 d. ☐ will be transmitted promptly upon request.  
 e. ☐ has been submitted by applicant on \_\_\_\_\_.  
 Date

12. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98:

- a. ☒ is transmitted herewith.  
 Also transmitted herewith is/are:  
☒ Form PTO-1449 (PTO/SB/08A and 08B).  
☒ Copies of citations listed.  
 b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).  
 c. ☐ was previously submitted by applicant on \_\_\_\_\_.  
 Date

13. ☒ An assignment document is transmitted herewith for recording.

A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING  
 NEW PATENT APPLICATION" or ☐ FORM PTO  
 1595 is also attached.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

14. ☒ Additional documents:

- a. ☐ Copy of request (PCT/RO/101)  
 b. ☒ International Publication No. WO00/74988  
 i. ☐ Specification, claims and drawing  
 ii. ☒ Front page only  
 c. ☒ Preliminary amendment (37 C.F.R. § 1.121)  
 d. ☐ Other

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

15. ☒ The above checked items are being transmitted

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- a. ☒ before 30 months from any claimed priority date.  
 b. ☒ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on \_\_\_\_\_, namely:

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### AUTHORIZATION TO CHARGE ADDITIONAL FEES

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.

**NOTE:** "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

**NOTE:** "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 18-0013.

☒ 37 C.F.R. 1.492(a)(1), (2), (3), and (4) (filing fees)

**WARNING:** Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.

☒ 37 C.F.R. 1.492(b), (c) and (d) (presentation of extra claims)

**NOTE:** Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

- ☒ 37 C.F.R. 1.17 (application processing fees)  
☒ 37 C.F.R. 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).  
☒ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

**NOTE:** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of

allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

- [X] 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

  
SIGNATURE OF PRACTITIONER

Joseph V. Coppola, Sr.

(type or print name of practitioner)

Reg. No.: 33,373

Tel. No.: (248) 594-0650

RADER, FISHMAN & GRAUER PLLC

P.O. Address

39533 Woodward Ave., Suite 140

Bloomfield Hills, MI 48304

CUSTOMER NO.: 010291



10291

PATENT TRADEMARK OFFICE



AP9650

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Volz

Int'l Application No.: PCT/EP00/05295

Int'l Filing Date: 8/June/2000

Serial No.:

Group Art Unit:

Filed: Herewith

Examiner:

For: Electromagnetic Valve

Attorney Docket No.: AP9650

Paper No.

Box PCT  
Commissioner of Patents  
Washington, D.C. 20231  
Attn: EO/US

CERTIFICATE OF MAILING/TRANSMISSION (37 CFR 1.8(a))

I hereby certify that this correspondence is, on the date shown below, being:

☒ deposited with the United States Postal Service  
with sufficient postage as Express Mail, Post Office  
to Addressee, Mailing Label No.: EV051007728US,  
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of Patents, Washington, DC 20231

☐ transmitted by facsimile to the Patent and Trademark Office.  
to Examiner \_\_\_\_\_ at \_\_\_\_\_

*Joyce Krumpe*  
Signature \_\_\_\_\_

Date: 12/6/01

Joyce Krumpe

**PRELIMINARY AMENDMENT**

Dear Sir:

Please amend the application as follows prior to examination on the merits.

**IN THE CLAIMS**

Please cancel claims 1-6 and add the following new claims.

7. (New) Electromagnetic valve, comprising:

a magnet armature,

a magnet core member,

a valve housing to which a valve coil is fitted and which accommodates a valve closure member and a valve seat, wherein the valve housing includes a first sleeve part which is made in a deepdrawing process and, includes a retaining collar that forms, in conjunction with the sleeve part, an independent, operatively preassembled module, wherein the sleeve part includes a preferably undetachable connection, provided by laser welding, either in an overlapping area with the retaining collar or in an overlapping area with a second sleeve part.

8. (New) Electromagnetic valve as claimed in claim 7, wherein an end of the first sleeve part is telescopically engaged over the second sleeve part and includes the retaining collar which is attached in the valve-accommodating member in a form-locking or operative connection.

9. (New) Electromagnetic valve as claimed in claim 8, wherein the valve seat is arranged in an end portion of the second sleeve part and the magnet core member is arranged in an end portion of the first sleeve part.

10. (New) Electromagnetic valve as claimed in claim 9, wherein the magnet armature is arranged as a stepped piston including the valve closure member between the valve seat and the magnet core member.

11. (New) Electromagnetic valve as claimed in any claim 8, wherein the second sleeve part has a stepped portion for accommodating a ring filter.

12. (New) Electromagnetic valve as claimed in claim 8, wherein the second sleeve part has a larger wall thickness than the first sleeve part.

**REMARKS**

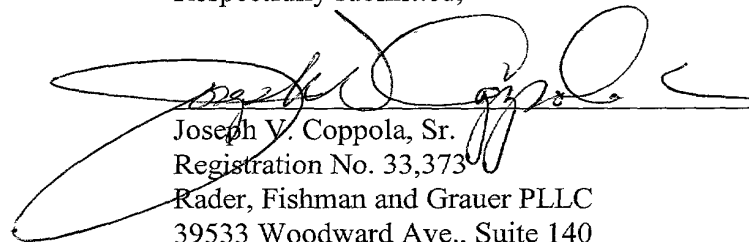
Prior to a formal examination of the above-identified application, acceptance of the new claims and the enclosed substitute specification (under 37 CFR 1.125) is respectfully requested. It is believed that the substitute specification and new claims will facilitate processing of the application in accordance with M.P.E.P. 608.01(q). The substitute specification and new claims are in compliance with 37 CFR 1.52 (a and b) and, while making no substantive changes, are submitted to conform this case to the formal requirements and long-established formal standards of U.S. Patent Office practice, and to provide improved idiom and better grammatical form.

The enclosed substitute specification is presented herein in both marked-up and clean versions.

**STATEMENT**

The undersigned, an attorney registered to practice before the office, hereby states that the enclosed substitute specification includes the same changes as are indicated in the mark-up copy of the original specification. The substitute specification contains no new subject matter.

Respectfully submitted,



Joseph V. Coppola, Sr.  
Registration No. 33,373  
Rader, Fishman and Grauer PLLC  
39533 Woodward Ave., Suite 140  
Bloomfield Hills, Michigan 48304  
(248) 594-0650  
Attorney for Applicants

SUBSTITUTE SPECIFICATION: CLEAN COPY

10009018 120501

## **Electromagnetic Valve**

### **Technical Field**

The present invention generally relates to valves, and more particularly relates to electromagnetic valves.

### **Background of The Invention**

DE 196 03 383 A1 discloses an electromagnetic valve of the mentioned type which, for attachment of the valve housing in the valve-accommodating member, includes a magnet end plate which has a clinched contour and on which a valve coil with a yoke ring is based. The magnet end plate additionally accommodates the open end of a dome-shaped sleeve part. The valve seat is secured to a cylinder insert which extends until a magnet armature into the sleeve part.

Consequently, the valve housing is composed of the cylinder insert which extends into the sleeve part and the valve seat secured thereto. In view of the forces present during assembly that act on the valve housing, the cylinder insert is manufactured from a massive turned part.

An object of the present invention is to manufacture an electromagnetic valve of the indicated type with least possible effort and structure and to provide a simple mounting support for this purpose, and another objective is to minimize the mechanical stress of the valve housing.

### **Brief Description of The Drawings**

Figure 1 is a cross-sectional view of a first embodiment of the electromagnetic valve of the present invention.

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Figure 2 shows an embodiment of the object of Figure 1 in the area of the valve seat.

Figure 3 shows another low-cost integration of the valve seat in the valve housing.

Figure 4 shows a favorable embodiment of the above-mentioned electromagnetic valves by using an integral valve sleeve.

### **Detailed Description of The Preferred Embodiments**

The embodiment of Figure 1 is a considerably enlarged view of a longitudinal cross-section taken through an electromagnetic valve having a valve housing which is composed of two sleeve parts 1, 2 made in a deep-drawing process and joined in one another so that an independent and operatively preassembled valve module is produced which, according to the drawings, accommodates a valve seat 5 and a ring seal 12 in the bottom second sleeve part 2. The valve module carries a magnet core member 6 in the first sleeve part 1 shown in the drawing. The ring seal 12 prevents a bypass flow between the two pressure fluid channels 13, 14 along the wall between the electromagnetic valve and the valve-accommodating member 4. The valve seat 5 and the magnet core member 6 are fixed in the walls of the sleeve parts 1, 2 by means of partial indentations 16.

Both sleeve parts 1, 2 with their end portions remote from the valve seat 5 and the magnet core member 6 are telescopically slid into one another and undetachably connected from outside by means of laser welding in this overlapping area. In order to fasten the valve housing in the valve-accommodating member 4 of the drawings, the external first sleeve part 1 which projects over the second sleeve part 2 includes a retaining collar 3 which is reliably and pressure-fluid-tightly secured therein by an outside calked portion of the material of the valve-accommodating member 4. Instead of the illustrated outside calked portion 18, the retaining collar 3, if appropriate for welding operations, may also be welded to the valve-accommodating member 4.

The second sleeve part 2 further has a stepped portion 9 so that a ring filter 10 may be arranged in this area. Due to the thin wall of the second sleeve part 2 this ring filter 10 can be arranged both on the outside and the inside periphery of the sleeve part 2. When arranged in the area of the inside sleeve periphery, the ring filter 10 can additionally take over a guiding function for the tappet-shaped portion on the magnet armature. On the other hand, a corresponding deformation (waist) of the sleeve part 2 also permits achieving such a guiding function.

A magnet armature 7 that is adapted to the inside contour of the stepped valve housing 2 is thus movably arranged between the valve seat 5 and the magnet core member 6. In the basic position of the magnet armature, a spherical valve closure member 8 fitted to the magnet armature 7 bears against the valve seat 5 in a pressure-fluid tight manner under the effect of a compression spring 11 disposed between the magnet core member 6 and the magnet armature 7.

The pressure fluid connection by way of the pressure fluid channels 13, 14, which are arranged transversely and longitudinally to the valve axis in the valve-accommodating member 4, is interrupted in the electromagnetically closed basic position of the valve. In the electromagnetically energized valve operating position, there is an uninhibited pressure fluid connection by way of the open valve seat 5 and by way of the through-bore 15 which is disposed in the second sleeve part 2 at the level of the ring filter 10 between the two pressure fluid channels 13, 14. Upon request or requirement, the through-bore 15 may be configured as a calibration bore, which is e.g. made in a stamping process, and may thus perform an orifice function.

Different from the valve design according to Figure 1, Figure 2 shows the valve seat 5 designed as a valve plate and arranged within the second sleeve part 2, abutting on the said's sleeve bottom. The second sleeve part 2 is designed as a deepdrawn bowl and like in the sleeve periphery also includes a through-bore 15 in the sleeve bottom. The ring seal 12 is thereby positioned between the sleeve periphery, the ring filter 10,1 and the stepped bore of

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the valve-accommodating member 4. As regards the other valve details of Figure 2, reference is made to the above explanations with respect to Figure 1.

A particularly adept integration of the valve seat 5 in the second sleeve part 2 can be taken from Figure 3, according to which the contour of the valve seat 5 is indented directly into the sleeve bottom, preferably by means of a stamping process. All other valve details according to Figure 3 also correspond to the basic design of the electromagnetic valves of Figures 1 and 2 so that in detail the description of Figures 1 and 2 also applies to Figure 3.

If requested or required, it is, of course, possible upon to modify the embodiments explained above in their details in a suitable fashion. One possibility is e.g. to arrange the ring filter 12 within the second sleeve part 2 due to the especially slim, thin-wall sleeve construction.

The inner cleanliness of the electromagnetic valve can still be improved by arranging another filter element in the area of the valve seat 5 so that due to the space-saving construction of the second sleeve part 2 e.g. between the bottom of the valve-accommodating member 4 and the valve seat 5 the intermediate space can be used by a plate-type filter 17.

Further, as is shown in Figure 4, the suggested dome-shaped design of the first sleeve part 1 may be omitted, if desired or required, and the magnet core member 6 will then adopt the function of a plug that closes the first sleeve 1. In Figure 4, the valve housing is configured as a one-piece sleeve part 1 which, different from the bowl shape of the sleeve part 2 according to Figures 2 and 3, extends with its extended sleeve stem until the plug-shaped magnet end part 6 so that the retaining collar 3 is represented as a separate deepdrawn part which is welded to the sleeve part. A form-locking attachment alternative is e.g. the so-called curling process and the inside pressure deformation for expanding the sleeve part 1 in the area of the retaining collar 3 which is then reinforced in its wall thickness due to the intensified stress.

The significant aspects of the present invention can be seen in that the valve housing 12 due to the retaining collar 3 chosen can be attached directly in the valve-accommodating member 4 in a calked fashion with minimum effort and structure. An optimal condition for laser



[illegible]

Using smallest wall thicknesses for both sleeve parts 1, 2 promotes the optimum design of the magnetic circuit.

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## **Electromagnetic Valve**

### **Abstract of The Disclosure**

The present invention relates to an electromagnetic valve including a magnet armature, a magnet core member, a valve housing to which a valve coil is fitted and which accommodates a valve closure member and a valve seat. The valve housing is composed of a first sleeve part which is made in a deepdrawing process and, in the direction of a valve-accommodating member, includes a retaining collar that forms along with the sleeve part an independent, operatively preassembled module, and the sleeve part constituting a preferably undetachable connection, provided by laser welding, either in an overlapping area with the retaining collar and/or in an overlapping area with a second sleeve part.

SUBSTITUTE SPECIFICATION: MARKED UP COPY

## Electromagnetic Valve

### Technical Field

The present invention generally relates to valves, and more particularly relates to [an] electromagnetic valves [according to the preamble of patent claim 1].

## Background of The Invention

DE 196 03 383 A1 discloses an electromagnetic valve of the mentioned type which, for attachment of the valve housing in the valve-accommodating member, includes a magnet end plate which has a clinched contour and on which a valve coil with a yoke ring is based. The magnet end plate additionally accommodates the open end of a dome-shaped sleeve part. The valve seat is secured to a cylinder insert which extends until a magnet armature into the sleeve part.

Consequently, the valve housing is composed of the cylinder insert which extends into the sleeve part and the valve seat secured thereto. In view of the [press-in] forces present during assembly that act on the valve housing, the cylinder insert is manufactured from a massive turned part.

An object of the present invention is to manufacture an electromagnetic valve of the indicated type with least possible effort and structure and to provide a simple mounting support for this purpose, and another objective is to minimize the mechanical stress of the valve housing.

[According to the present invention, this object is achieved for an electromagnetic valve of the indicated type with the characterizing features of patent claim 1.

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Further features, advantages and possible applications of the present invention can be seen in the following from the description of several embodiments.

In the drawings,]

### **Brief Description of The Drawings**

- Figure 1 is a cross-sectional view of a first embodiment of the electromagnetic valve of the present invention.
- Figure 2 shows an embodiment of the object of Figure 1 in the area of the valve seat.
- Figure 3 shows another low-cost integration of the valve seat in the valve housing.
- Figure 4 shows a favorable embodiment of the above-mentioned electromagnetic valves by using an integral valve sleeve.

### **Detailed Description of The Preferred Embodiments**

The embodiment of Figure 1 is a considerably enlarged view of a longitudinal cross-section taken through an electromagnetic valve having a valve housing which is composed of two sleeve parts 1, 2 made in a deep-drawing process and joined in one another so that an independent and operatively preassembled valve module is produced which, according to the drawings, accommodates a valve seat 5 and a ring seal 12 in the bottom second sleeve part 2. The valve module carries a magnet core member 6 in the first sleeve part 1 shown in the drawing. The ring seal 12 prevents a bypass flow between the two pressure fluid channels 13, 14 along the wall between the electromagnetic valve and the valve-accommodating member 4. The valve seat 5 and the magnet core member 6 are fixed in the walls of the sleeve parts 1, 2 by means of partial indentations 16.

Both sleeve parts 1, 2 with their end portions remote from the valve seat 5 and the magnet core member 6 are [sectionwise] telescopically slid into one another and undetachably connected from outside by means of laser welding in this overlapping area. In order to fasten the valve housing in the valve-accommodating member 4 of the drawings, the external first sleeve part 1 which projects over the second sleeve part 2 includes a retaining collar 3 which is reliably and pressure-fluid-tightly secured therein by an outside calked portion of the material of the valve-accommodating member 4. Instead of the illustrated outside calked portion 18, the retaining collar 3, if appropriate for welding operations, may also be welded to the valve-accommodating member 4.

The second sleeve part 2 further has a stepped portion 9 so that a ring filter 10 may be arranged in this area. Due to the thin wall of the second sleeve part 2 this ring filter 10 can be arranged both on the outside and the inside periphery of the sleeve part 2. When arranged in the area of the inside sleeve periphery, the ring filter 10 can additionally take over a guiding function for the tappet-shaped portion on the magnet armature. On the other hand, a corresponding deformation (waist) of the sleeve part 2 also permits achieving such a guiding function.

A magnet armature 7 that is adapted to the inside contour of the stepped valve housing 2 is thus movably arranged between the valve seat 5 and the magnet core member 6. In the basic position of the magnet armature, a spherical valve closure member 8 fitted to the magnet armature 7 bears against the valve seat 5 in a pressure-fluid tight manner under the effect of a compression spring 11 disposed between the magnet core member 6 and the magnet armature 7.

The pressure fluid connection [via] by way of the pressure fluid channels 13, 14, which are arranged transversely and longitudinally to the valve axis in the valve-accommodating member 4, [are] is interrupted in the electromagnetically closed basic position of the valve. In the electromagnetically energized valve operating position, there is an uninhibited pressure fluid connection by way of the open valve seat 5 and by way of the through-bore 15 which is disposed in the second sleeve part 2 at the level of the ring filter 10 between the two pressure

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fluid channels 13, 14. Upon request or requirement, the through-bore 15 may be configured as a calibration bore, which is e.g. made in a stamping process, and may thus perform an orifice function.

Different from the valve design according to Figure 1, Figure 2 shows the valve seat 5 designed as a valve plate and arranged within the second sleeve part 2, abutting on the said's sleeve bottom. The second sleeve part 2 is designed as a deepdrawn bowl and like in the sleeve periphery also includes a through-bore 15 in the sleeve bottom. The ring seal 12 is thereby positioned between the sleeve periphery, the ring filter 10,1 and the stepped bore of the valve-accommodating member 4. As regards the other valve details of Figure 2, reference is made to the above explanations with respect to Figure 1.

A particularly adept integration of the valve seat 5 in the second sleeve part 2 can be taken from Figure 3, according to which the contour of the valve seat 5 is indented directly into the sleeve bottom, preferably by means of a stamping process. All other valve details according to Figure 3 also correspond to the basic design of the electromagnetic valves of Figures 1 and 2 so that in detail the description of Figures 1 and 2 also applies to Figure 3.

If requested or required, it is, of course, possible upon to modify the embodiments explained above in their details in a suitable fashion. One possibility is e.g. to arrange the ring filter 12 within the second sleeve part 2 due to the especially slim, thin-wall sleeve construction.

The inner cleanliness of the electromagnetic valve can still be improved by arranging another filter element in the area of the valve seat 5 so that due to the space-saving construction of the second sleeve part 2 e.g. between the bottom of the valve-accommodating member 4 and the valve seat 5 the intermediate space can be used by a plate-type filter 17.

Further, as is shown in Figure 4, the suggested dome-shaped design of the first sleeve part 1 may be omitted, if desired or required, and the magnet core member 6 will then adopt the function of a plug that closes the first sleeve 1. In Figure 4, the valve housing is configured as a one-piece sleeve part 1 which, different from the bowl shape of the sleeve part 2 according

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to Figures 2 and 3, extends with its extended sleeve stem until the plug-shaped magnet end part 6 so that the retaining collar 3 is represented as a separate deepdrawn part which is welded to the sleeve part. A form-locking attachment alternative is e.g. the so-called curling process and the inside pressure deformation for expanding the sleeve part 1 in the area of the retaining collar 3 which is then reinforced in its wall thickness due to the intensified stress.

The significant aspects of the present invention can be seen in that the valve housing 12 due to the retaining collar 3 chosen can be attached directly in the valve-accommodating member 4 in a calked fashion with minimum effort and structure. An optimal condition for laser welding of the outside surface of the sleeve part 1 with the second sleeve part 2 is achieved by the fact that the second sleeve part 2 which is slightly thicker than the first sleeve part 1 is positioned within the first sleeve part 1. The chosen construction also permits the use of a hardenable material for the second sleeve 2 so that wear problems will not occur for the valve seat 5 when the said is placed directly in the bottom of the second sleeve part 2.

Using smallest wall thicknesses for both sleeve parts 1, 2 promotes the optimum design of the magnetic circuit.



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[List of Reference Numerals:

- 1 first sleeve part
- 2 second sleeve part
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- 7 magnet armature
- 8 valve closure member
- 9 stepped portion
- 10 ring filter
- 11 compression spring
- 12 ring seal
- 13 pressure fluid channel
- 14 pressure fluid channel
- 15 through-bore
- 16 indentation
- 17 plate-type filter
- 18 outside calked portion]

[Abstract:]

## **Electromagnetic Valve**

### **Abstract of The Disclosure**

The present invention relates to an electromagnetic valve including a magnet armature, a magnet core member, a valve housing to which a valve coil is fitted and which accommodates a valve closure member and a valve seat. The valve housing is composed of a first sleeve part [(1)] which is made in a deepdrawing process and, in the direction of a valve-accommodating member [(4)], includes a retaining collar [(3)] that forms along with the sleeve part [(1)] an independent, operatively preassembled module, and the sleeve part [(1)] constituting a preferably undetachable connection, provided by laser welding, either in an overlapping area with the retaining collar [(3)] and/or in an overlapping area with a second sleeve part [(2)].

[Figure 1]

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Electromagnetic Valve

The present invention relates to an electromagnetic valve according to the preamble of patent claim 1.

DE 196 03 383 A1 discloses an electromagnetic valve of the mentioned type which, for attachment of the valve housing in the valve-accommodating member, includes a magnet end plate which has a clinched contour and on which a valve coil with a yoke ring is based. The magnet end plate additionally accommodates the open end of a dome-shaped sleeve part. The valve seat is secured to a cylinder insert which extends until a magnet armature into the sleeve part.

Consequently, the valve housing is composed of the cylinder insert which extends into the sleeve part and the valve seat secured thereto. In view of the press-in forces that act on the valve housing, the cylinder insert is manufactured from a massive turned part.

An object of the present invention is to manufacture an electromagnetic valve of the indicated type with least possible effort and structure and to provide a simple mounting support for this purpose, and another objective is to minimize the mechanical stress of the valve housing.

According to the present invention, this object is achieved for an electromagnetic valve of the indicated type with the characterizing features of patent claim 1.

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Further features, advantages and possible applications of the present invention can be seen in the following from the description of several embodiments.

In the drawings,

Figure 1 is a cross-sectional view of a first embodiment of the electromagnetic valve of the present invention.

Figure 2 shows an embodiment of the object of Figure 1 in the area of the valve seat.

Figure 3 shows another low-cost integration of the valve seat in the valve housing.

Figure 4 shows a favorable embodiment of the above-mentioned electromagnetic valves by using an integral valve sleeve.

The embodiment of Figure 1 is a considerably enlarged view of a longitudinal cross-section taken through an electromagnetic valve having a valve housing which is composed of two sleeve parts 1, 2 made in a deep-drawing process and joined in one another so that an independent and operatively preassembled valve module is produced which, according to the drawings, accommodates a valve seat 5 and a ring seal 12 in the bottom second sleeve part 2. The valve module carries a magnet core member 6 in the first sleeve part 1 shown in the drawing. The ring seal 12 prevents a bypass flow between the two pressure fluid channels 13, 14 along the wall between the electromagnetic valve and the valve-accommodating member 4. The valve seat 5 and the magnet core member 6 are fixed in the walls of the sleeve parts 1, 2 by means of partial indentations 16.

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Both sleeve parts 1, 2 with their end portions remote from the valve seat 5 and the magnet core member 6 are sectionwise slid into one another and undetachably connected from outside by means of laser welding in this overlapping area. In order to fasten the valve housing in the valve-accommodating member 4 of the drawings, the external first sleeve part 1 which projects over the second sleeve part 2 includes a retaining collar 3 which is reliably and pressure-fluid-tightly secured therein by an outside calked portion of the material of the valve-accommodating member 4. Instead of the illustrated outside calked portion 18, the retaining collar 3, if appropriate for welding operations, may also be welded to the valve-accommodating member 4.

The second sleeve part 2 further has a stepped portion 9 so that a ring filter 10 may be arranged in this area. Due to the thin wall of the second sleeve part 2 this ring filter 10 can be arranged both on the outside and the inside periphery of the sleeve part 2. When arranged in the area of the inside sleeve periphery, the ring filter 10 can additionally take over a guiding function for the tappet-shaped portion on the magnet armature. On the other hand, a corresponding deformation (waist) of the sleeve part 2 also permits achieving such a guiding function.

A magnet armature 7 that is adapted to the inside contour of the stepped valve housing 2 is thus movably arranged between the valve seat 5 and the magnet core member 6. In the basic position of the magnet armature, a spherical valve closure member 8 fitted to the magnet armature 7 bears against the valve seat 5 in a pressure-fluid tight manner under the effect of a compression spring 11 disposed between the magnet core member 6 and the magnet armature 7.

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The pressure fluid connection via the pressure fluid channels 13, 14 which are arranged transversely and longitudinally to the valve axis in the valve-accommodating member 4 are interrupted in the electromagnetically closed basic position of the valve. In the electromagnetically energized valve operating position, there is an uninhibited pressure fluid connection by way of the open valve seat 5 and by way of the through-bore 15 which is disposed in the second sleeve part 2 at the level of the ring filter 10 between the two pressure fluid channels 13, 14. Upon request or requirement, the through-bore 15 may be configured as a calibration bore, which is e.g. made in a stamping process, and may thus perform an orifice function.

Different from the valve design according to Figure 1, Figure 2 shows the valve seat 5 designed as a valve plate and arranged within the second sleeve part 2, abutting on the said's sleeve bottom. The second sleeve part 2 is designed as a deepdrawn bowl and like in the sleeve periphery also includes a through-bore 15 in the sleeve bottom. The ring seal 12 is thereby positioned between the sleeve periphery, the ring filter 10,1 and the stepped bore of the valve-accommodating member 4. As regards the other valve details of Figure 2, reference is made to the above explanations with respect to Figure 1.

A particularly adept<sup>\*</sup> integration of the valve seat 5 in the second sleeve part 2 can be taken from Figure 3, according to which the contour of the valve seat 5 is indented directly into the sleeve bottom, preferably by means of a stamping process. All other valve details according to Figure 3 also correspond to the basic design of the electromagnetic valves of Figures 1 and 2 so that in detail the description of Figures 1 and 2 also applies to Figure 3.

If requested or required, it is, of course, possible upon to modify the embodiments explained above in their details in a

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suitable fashion. One possibility is e.g. to arrange the ring filter 12 within the second sleeve part 2 due to the especially slim, thin-wall sleeve construction.

The inner cleanliness of the electromagnetic valve can still be improved by arranging another filter element in the area of the valve seat 5 so that due to the space-saving construction of the second sleeve part 2 e.g. between the bottom of the valve-accommodating member 4 and the valve seat 5 the intermediate space can be used by a plate-type filter 17.

Further, as is shown in Figure 4, the suggested dome-shaped design of the first sleeve part 1 may be omitted, if desired or required, and the magnet core member 6 will then adopt the function of a plug that closes the first sleeve 1. In Figure 4, the valve housing is configured as a one-piece sleeve part 1 which, different from the bowl shape of the sleeve part 2 according to Figures 2 and 3, extends with its extended sleeve stem until the plug-shaped magnet end part 6 so that the retaining collar 3 is represented as a separate deepdrawn part which is welded to the sleeve part. A form-locking attachment alternative is e.g. the so-called curling process and the inside pressure deformation for expanding the sleeve part 1 in the area of the retaining collar 3 which is then reinforced in its wall thickness due to the intensified stress.

The significant aspects of the present invention can be seen in that the valve housing 12 due to the retaining collar 3 chosen can be attached directly in the valve-accommodating member 4 in a calked fashion with minimum effort and structure. An optimal condition for laser welding of the outside surface of the sleeve part 1 with the second sleeve part 2 is achieved by the fact that the second sleeve part 2 which is slightly thicker than the first sleeve part 1 is positioned within the first sleeve part 1. The chosen construction also permits the use of

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a hardenable material for the second sleeve 2 so that wear problems will not occur for the valve seat 5 when the said is placed directly in the bottom of the second sleeve part 2.

Using smallest wall thicknesses for both sleeve parts 1, 2 promotes the optimum design of the magnetic circuit.

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List of Reference Numerals:

- 1 first sleeve part
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- 13 pressure fluid channel
- 14 pressure fluid channel
- 15 through-bore
- 16 indentation
- 17 plate-type filter
- 18 outside calked portion

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Patent Claims:

1. Electromagnetic valve, including a magnet armature, a magnet core member, a valve housing to which a valve coil is fitted and which accommodates a valve closure member and a valve seat,  
c h a r a c t e r i z e d in that the valve housing is composed of a first sleeve part (1) which is made in a deepdrawing process and, in the direction of a valve-accommodating member (4), includes a retaining collar (3) that forms along with the sleeve part (1) an independent, operatively preassembled module, and the sleeve part (1) constituting a preferably undetachable connection, provided by laser welding, either in an overlapping area with the retaining collar (3) and/or in an overlapping area with a second sleeve part (2).
2. Electromagnetic valve as claimed in claim 1,  
c h a r a c t e r i z e d in that the end of the first sleeve part (1) that is slipped over the second sleeve part (2) includes the retaining collar (3) which is attached in the valve-accommodating member (4) provided for the electromagnetic valve in a form-locking and/or operative connection, preferably is calked in the valve-accommodating member (4).
3. Electromagnetic valve as claimed in claim 1 or 2,  
c h a r a c t e r i z e d in that the valve seat (5) is arranged in the end portion of the second sleeve part (2) and the magnet core member (6) is arranged in the end portion of the first sleeve part (1).

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4. Electromagnetic valve as claimed in claim 3,  
c h a r a c t e r i z e d in that the magnet armature  
(7) is arranged as a stepped piston including the valve  
closure member (8) between the valve seat (5) and the  
magnet core member (6).
5. Electromagnetic valve as claimed in any one of the  
preceding claims 1 to 3,  
c h a r a c t e r i z e d in that the second sleeve  
part (2) has a stepped portion (9) for accommodating a  
ring filter (10).
6. Electromagnetic valve as claimed in any one of the  
preceding claims 1 to 3,  
c h a r a c t e r i z e d in that the second sleeve  
part (2) has a larger wall thickness compared to the first  
sleeve part (1).

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Fig. 1

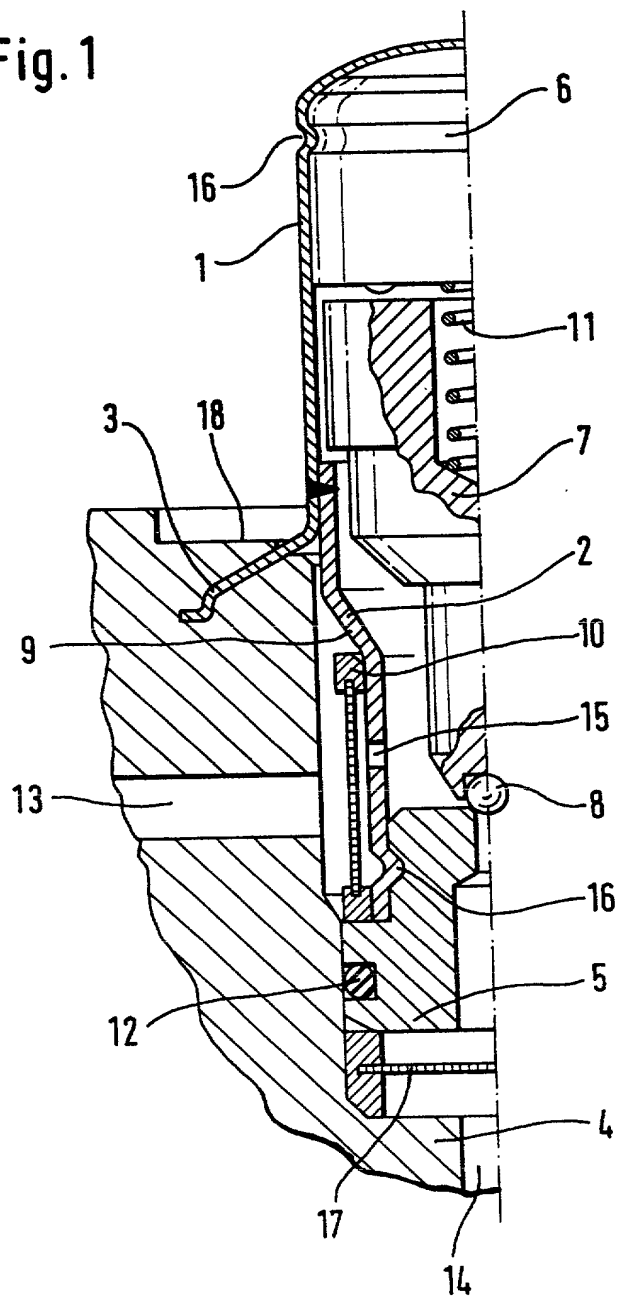
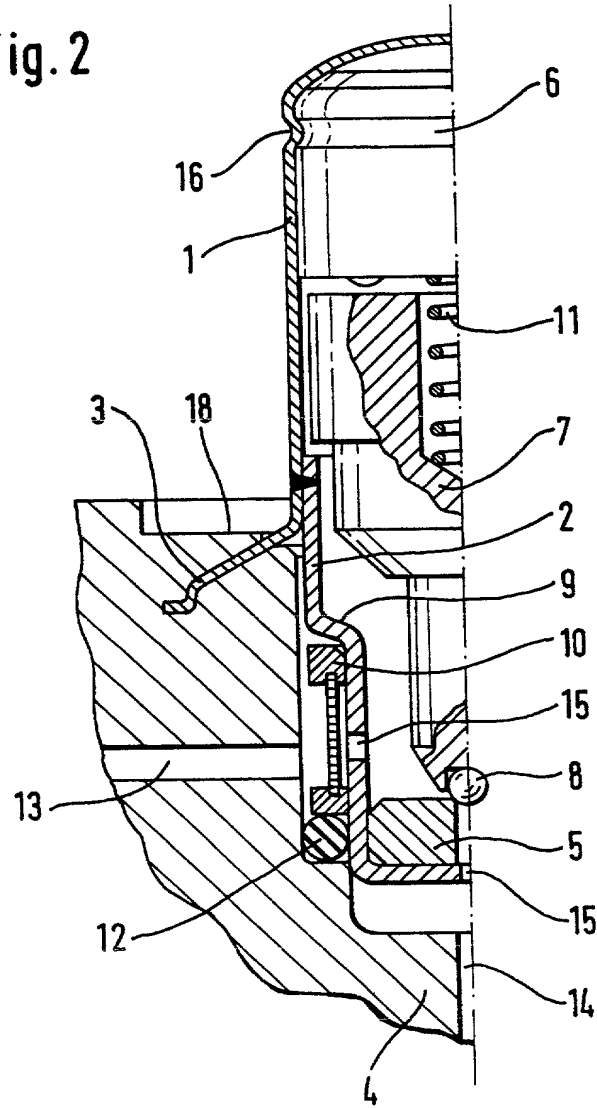


Fig. 2



**Fig. 3**

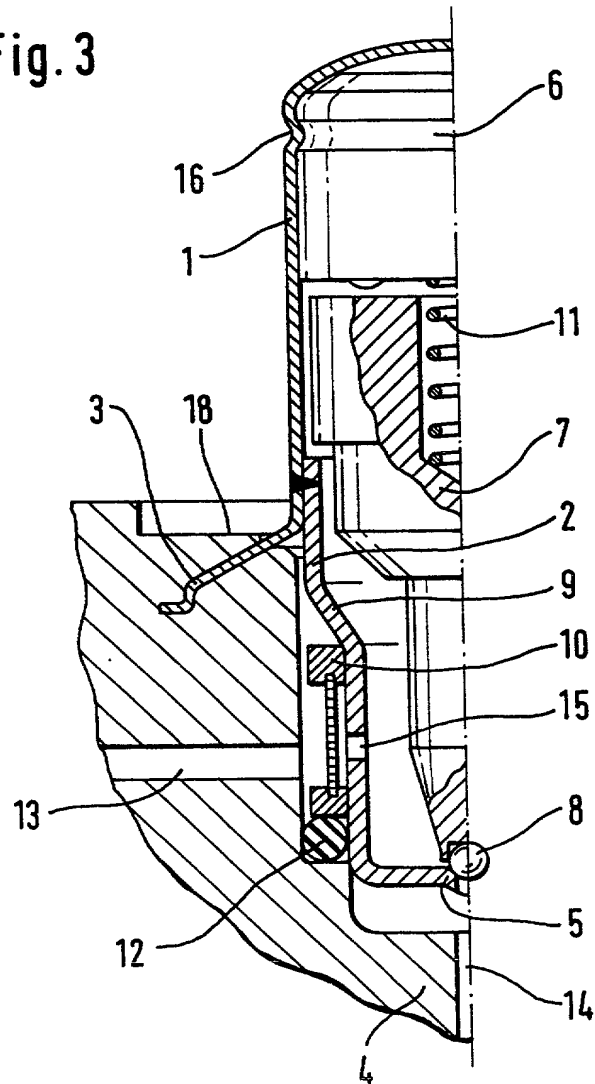
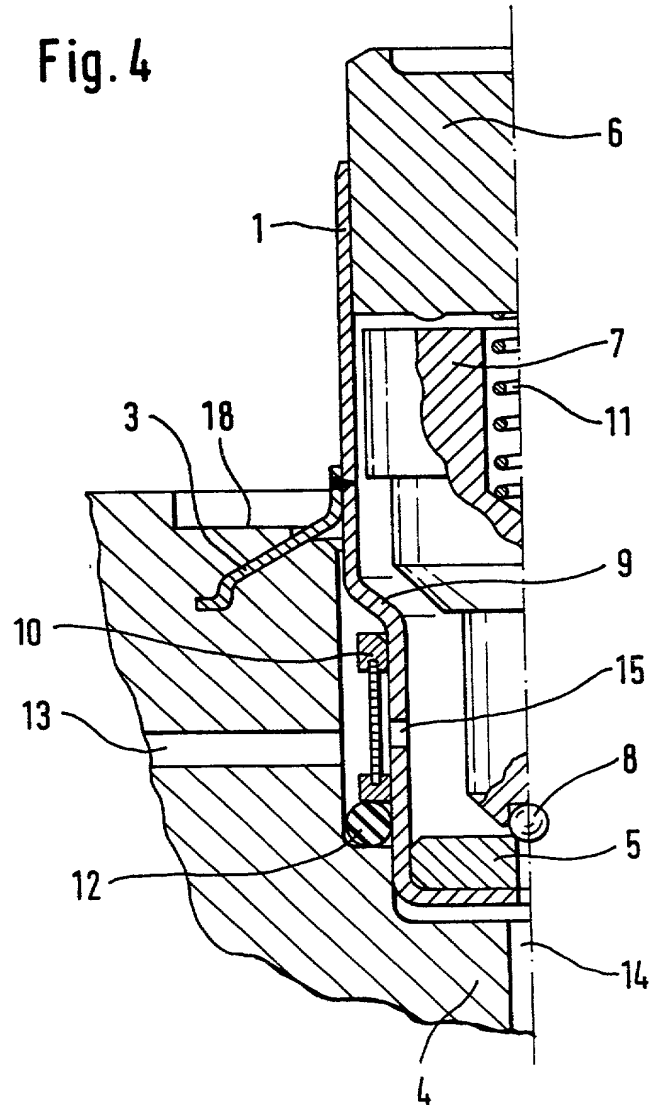


Fig. 4



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# Declaration and Power of Attorney for Patent Application

## Erklärung für Patentanmeldungen mit Vollmacht

### German Language Declaration

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deren Beschreibung hier beigelegt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung

- ☒ wurde angemeldet am  
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Vertrags über die Zusammenarbeit auf dem Gebiet  
des Patentwesens (PCT).

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Ich erkenne meine Pflicht zur Offenbarung jeglicher Informationen an, die eventuell zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, Code of Federal Regulations, § 1.56 von Belang sind.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

### ELECTROMAGNETIC VALVE

the specification of which is attached hereto unless the following box is checked:

- ☒ was filed on **08/JUNE/2000** ✓  
as United States Application Number or PCT  
International Application Number  
**PCT/EP00/05295** ✓

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and as amended in a preliminary amendment.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

[Page 1 of 3]

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I hereby claim foreign priority under Title 35, United States Code, §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications  
(Frühere ausländische Anmeldungen)

Priority Not Claimed  
Priorität nicht beansprucht

199 25 935.6 ✓      Germany ✓  
100 03 204.4 ✓      Germany ✓  
Number                      Country

08/June/1999 ✓  
26/January/2000 ✓  
Day/Month/Year Filed



Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, § 119(e) aller US-Hilfsanmeldungen wie unten aufgezählt.

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Application No.      , filed on

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I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application No.      , filed on

Status: patented/pending/abandoned)

Application No.      , filed on

Status: patented/pending/abandoned)

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**German Language Declaration**

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Joseph V. Coppola 33,373  
Customer No. 010291

Korrespondenzadresse:  
Joseph V. Coppola, Sr.  
Rader, Fishman & Grauer PLLC  
Suite 140  
39533 Woodward Avenue  
Bloomfield Hills MI 48304  
Telefon: (248) 594-0650

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:



Joseph V. Coppola, Sr., Reg. 33373

10291

Customer No. 010291

PATENT TRADEMARK OFFICE

Correspondence Address:  
Joseph V. Coppola, Sr.  
Rader, Fishman & Grauer PLLC  
Suite 140  
39533 Woodward Avenue  
Bloomfield Hills MI 48304  
Phone No.: (248) 594-0650

## FIRST NAMED INVENTOR

PETER VOLZ

*[Signature]* 23/11/01

Signature

Date

## P.O. ADDRESS and RESIDENCE

In den Wingerten 14  
D-64291 Darmstadt, Germany *DEX*

Citizen of Germany ✓

## THIRD NAMED INVENTOR

Signature

Date

## P.O. ADDRESS and RESIDENCE

Citizen of

## SECOND NAMED INVENTOR

Signature

Date

## P.O. ADDRESS and RESIDENCE

Citizen of

## FOURTH NAMED INVENTOR

Signature

Date

## P.O. ADDRESS and RESIDENCE

Citizen of



If box is checked, subsequent inventors are listed on a separate sheet